CLAIMS

What is claimed is:

1. A method for managing interference in a radio communications network, comprising the steps of:

    receiving an aggregated radio signal at a first node in the radio communications network on a plurality of frequencies;

    determining a power level for the aggregated radio signal for each frequency in the plurality frequencies;

    subtracting the power level for each the frequency from a power limit to produce a power differentials for the each frequency; and

    instructing a second node in the radio communications network to avoid using a transmission frequency corresponding to a non-positive power differential in the plurality of power differentials to transmit to the first node.

2. The method of claim 1, further comprising the steps of:

    receiving a transmission from the second node in the radio communications network; and

    discarding any portion of the transmission carried on the transmission frequency.

3. The method of claim 1, wherein the step of determining a power level is carried out by:

    acquiring a plurality of instantaneous power level measurements for each the frequency; and

    calculating an average power level based on the plurality of instantaneous power level measurements.

4. The method of claim 1, wherein the step of determining a power level is carried out by:

acquiring a plurality of instantaneous power level measurements for the each frequency; and

calculating a median power level based on the plurality of instantaneous power level measurements.

5. The method of claim 2, wherein the discarding step comprises applying a filter to the transmission.

6. The method of claim 1, further comprising the step of:

sending to the second node a request to adjust a transmission power level on a frequency corresponding to a positive power differential in the plurality of power differentials.

7. The method of claim 1, further comprising the step of:

instructing a plurality of other nodes in the radio communications network to avoid using the transmission frequency to transmit information to the first node.

8. The method of claim 7, further comprising the steps of:

receiving a transmission from one of the plurality of other nodes; and

discarding any portion of the second transmission carried on a frequency corresponding to a non-positive power differential in the plurality of power differentials.

9. The method of claim 8, further comprising the step of:

sending to the one of the plurality of other nodes a request to adjust a transmit power level on a frequency corresponding to a positive power differential in the plurality of power differentials.

10. The method of claim 1, further comprising the steps of:

determining an updated power level for the aggregated radio signal for each frequency in the plurality frequencies;

subtracting the updated power level for each the frequency from the power limit to produce a plurality of updated power differentials; and

instructing the second node to avoid transmitting to the first node on a frequency corresponding to a non-positive updated power differential in the plurality of updated power differentials.

11. The method of claim 1, further comprising the steps of:

generating an optimal waveform profile based on the plurality of power differentials; and

reporting the optimal waveform profile to the second node.

12. The method of claim 11, wherein the reporting step is carried out using a common network configuration channel.

13. The method of claim 11, further comprising the step of compressing the optimal waveform profile prior to performing the reporting step.

14. The method of claim 11, wherein the optimal waveform profile specifies a waveform pattern.

15. The method of claim 14, wherein the waveform pattern defines a transmission signal having a power spectral density that varies over time.

16. The method of claim 14, further comprising the steps of:

generating a second optimal waveform profile based on the plurality of power differentials; and

reporting the second optimal waveform profile to a third node in the radio communications network;

wherein the second optimal waveform profile specifies a second waveform pattern that is orthogonal to the waveform pattern.

17. The method of claim 1, wherein the power limit is specified by a rule-making body.

18. The method of claim 1, wherein the power limit is specified by an industry standard.

19. The method of claim 1, wherein the plurality of frequencies comprises all of the frequencies in a radio frequency band.

20. The method of claim 1, further comprising the steps of:

associating a unique pattern with the second node; and

determining whether the transmission contains the unique pattern.

21. A method for managing interference in a radio communications network, comprising the steps of:

receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;

filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies; and

transmitting the transmission signal to the second node.

22. The method of claim 21, further comprising the steps of:

receiving an optimal waveform profile from the second node, the optimal waveform profile being based on a plurality of power measurements for the plurality of frequencies and a power limit; and

conforming the transmission signal to the optimal waveform profile prior to performing the transmitting step.

23. The method of claim 22, further comprising the step of decompressing the optimal waveform profile prior to performing the conforming step.

24. The method of claim 22, wherein the power limit is specified by a rule-making body.

25. The method of claim 22, wherein the power limit is specified by an industry standard.

26. A method of managing interference in a radio communications network, the radio communications network having a multiplicity of nodes, each node in the multiplicity having attached thereto a set of antennas, each antenna in the set being oriented in a unique direction relative to other antennas attached to each the node, the method comprising the steps of:

dividing the multiplicity of nodes into a plurality of node clusters;

assigning a unique receiving frequency to each node in at least one node cluster;

assigning a unique transmission frequency to each antenna in the set of antennas attached to a first node in the at least one node cluster;

wherein the unique transmission frequency assigned to the each antenna corresponds to the unique receiving frequency assigned to a neighboring node in the at least one node cluster; and

wherein the neighboring node is located in the unique direction in which each the antenna is oriented to face.

27. The method of claim 26, further comprising the step of transmitting an outgoing message from the first node to the neighboring node via a transmitting antenna in the set of antennas attached to the first node using the unique receiving frequency assigned to the neighboring node.

28. The method of claim 27, further comprising the step of transmitting a second outgoing message from the first node to another neighboring node in the at least one node cluster via a second transmitting antenna in the set of antennas attached to the first node using the unique receiving frequency assigned to the another neighboring node.

29. The method of claim 28, wherein the step of transmitting the outgoing message to the neighboring node and the step of transmitting the second outgoing message to the another neighboring node are carried out simultaneously.

30. The method of claim 27, further comprising the step of receiving, at the first node, via a second antenna in the set of antennas attached to the first node, an incoming message from another neighboring node in the at least one node cluster, using the unique receiving frequency assigned to the first node.

31. The method of claim 30, wherein the step of transmitting the outgoing message to the neighboring node and the step of receiving the incoming message from the another neighboring node are carried out simultaneously.

32. A radio communications device, comprising:

a receiver configured to receive an aggregated radio signal;

a spectrum analyzer, coupled to the receiver, configured to produce a series of power readings for the aggregated radio signal for each frequency in a plurality of frequencies;

a waveform profile generator configured to produce a waveform profile based on the series of power readings and a power limit, wherein the waveform profile defines a set of unacceptable transmission frequencies; and

a filter, coupled to the receiver, configured to detect in the aggregate radio signal a transmission signal addressed to the radio communications device, and to discard any portion of the transmission signal carried on a frequency corresponding to an unacceptable transmission frequency in the set of unacceptable transmission frequencies.

33. The radio communications device of claim 32, further comprising a signal data processor configured to generate a model power level for the aggregated radio signal for each frequency in the plurality frequencies based on the series of power readings.

34. The radio communications device of claim 33, wherein the signal data processor is further configured to calculate an average power level based on a plurality of instantaneous power level measurements.

35. The radio communications device of claim 33, wherein the signal data processor is further configured to calculate a median power level based on a plurality of instantaneous power level measurements.

36. The radio communications device of claim 32, wherein the waveform profile is further based on a set of power differentials between the power readings for each the frequency and the power limit.

37. The radio communications device of claim 32, further comprising a transmitter configured to transmit the waveform profile to a second radio communications device.

38. The radio communications device of claim 37, further comprising a correlator, coupled to the filter, configured to determine whether the transmission signal contains a pattern uniquely associated with the second radio communications device.

39. The radio communications device of claim 37, further comprising a plurality of correlators, coupled to the filter, configured to determine whether the transmission signal contains one of a multiplicity of patterns, each pattern being uniquely associated with one of a multiplicity of other radio communications devices.

40. The radio communications device of claim 39, wherein each pattern in the multiplicity of patterns is orthogonal to each other pattern in the multiplicity of patterns.

41. The radio communications device of claim 32, further comprising a media access controller configured to toggle the radio communications device between a transmit mode and a receive mode.

42. The radio communications device of claim 32, further comprising a compressor configured to compress the waveform profile.

43. A method for managing co-site interference in a wireless network having a multiplicity of nodes, comprising the steps of:

identifying a subset of nodes within the multiplicity of nodes, wherein each node in the subset is capable of transmitting data to each other node in the subset in accordance with a connectivity threshold and using a power setting that falls within a low power range;

defining a collection of transmission frequencies to be used by nodes of the subset only when transmitting to a node outside of the subset; and

permitting only one member of the subset at a time to transmit using any transmission frequency within the collection.

44. The method of claim 43, further comprising the step of serially allocating to the members of the subset permission to transmit using a transmission frequency within the collection.

45. The method of claim 43, further comprising the step of defining a range of high power levels to be used by members of the subset while using a transmission frequency within the collection.

46. The method of claim 43, further comprising repeating the identifying step.

47. The method of claim 43, further comprising repeating the identifying step according to a schedule.

48. The method of claim 43, further comprising repeating the identifying step at regular intervals.

49. The method of claim 43, further comprising repeating the identifying step if a node in the multiplicity of nodes has changed locations.

50. The method of claim 43, wherein the identifying step is carried out using a K-Means vector quantization algorithm.

51. The method of claim 44, wherein the serially allocating step is carried out using a point coordination function.

52. The method of claim 43, further comprising the steps of:

identifying a second subset of nodes within the multiplicity of nodes, wherein each node in the second subset is capable of transmitting data to each other node in the second subset in accordance with the connectivity threshold using a power setting that falls within a medium power range;

defining a second collection of transmission frequencies to be used by the nodes of the second subset to transmit using a power setting that falls outside the medium power range;

permitting only one node of the second subset at a time to transmit using any transmission frequency within the second collection.

53. The method of claim 52, further comprising the step of serially allocating to the members of the second subset permission to transmit using a transmission frequency within the second collection.

54. The method of claim 52, wherein the step of identifying a second subset is carried out using a K-Means vector quantization algorithm.

55. The method of claim 53, wherein the step of serially allocating is carried out using a point coordination function.

56. The method of claim 43, wherein all nodes in the subset are configured to receive transmissions on any transmission frequency in the collection while no node in the subset is transmitting on the any transmission frequency.

57. The method of claim 56, further comprising the steps of:

associating a defined waveform pattern with the subset of nodes; and

determining whether received transmissions contain the defined waveform pattern.

58. The method of claim 56, further comprising the steps of:

associating a unique spread spectrum code with the subset of nodes; and

determining whether received transmissions contain the spread spectrum code.

59. The method of claim 43, wherein the collection comprises a radio frequency band.

60. The method of claim 43, wherein the subset is configured as a wireless local area network.

61. The method of claim 43, wherein the subset is configured as a wireless metropolitan area network.

62. The method of claim 43, wherein the subset is configured as a wireless wide area network.

63. The method of claim 43, wherein the subset is configured as a wireless Intranet.

64. The method of claim 43, wherein the wireless network is the Internet.

65. A method for managing congestion at an elevated node in a wireless network having a multiplicity of nodes, comprising the steps of:

identifying a subset of nodes within the multiplicity of nodes, each node in the subset being capable of transmitting data to each other node in the subset in accordance with a connectivity threshold and using a power setting that falls within a low power range;

defining a collection of transmission frequencies to be used by nodes of the subset only when transmitting to the elevated node; and

permitting only one member of the subset at a time to transmit using any transmission frequency within the collection.

66. The method of claim 65, further comprising the step of serially allocating to the nodes of the subset permission to transmit using a transmission frequency within the collection.

67. The method of claim 65, further comprising the step of defining a range of high power levels to be used by nodes of the subset while using a transmission frequency within the collection.

68. The method of claim 65, further comprising repeating the identifying step.

69. The method of claim 65, further comprising repeating the identifying step according to a schedule.

70. The method of claim 65, further comprising repeating the identifying step at regular intervals.

71. The method of claim 65, further comprising repeating the identifying step if a node in the multiplicity of nodes has changed locations.

72. The method of claim 65, wherein the identifying step is carried out using a K-Means vector quantization algorithm.

73. The method of claim 66, wherein the step of serially allocating is carried out using a point coordination function.

74. The method of claim 65, wherein all nodes in the subset are configured to receive transmissions on any transmission frequency in the collection while no node in the subset is transmitting on the any transmission frequency.

75. The method of claim 74, further comprising the steps of:

associating a defined waveform pattern with the subset of nodes; and

determining whether received transmissions contain the defined waveform pattern.

76. The method of claim 74, further comprising the steps of:

associating a unique spread spectrum code with the subset of nodes; and

determining whether received transmissions contain the spread spectrum code.

77. The method of claim 65, wherein the collection comprises a radio frequency band.

78. The method of claim 65, wherein the subset is configured as a wireless local area network.

79. The method of claim 65, wherein the subset is configured as a wireless metropolitan area network.

80. The method of claim 65, wherein the subset is configured as a wireless wide area network.

81. The method of claim 65, wherein the subset is configured as a wireless Intranet.

82. The method of claim 65, wherein the wireless network is the Internet.

83. A wireless network, comprising:

a plurality of short-range links;

a multiplicity of nodes configured to

automatically identify a cluster of nodes within the multiplicity capable of transmitting data to each other node in the cluster via the plurality

of short-range links using a power setting that falls within a low power range, and

select a node in the cluster to act as a long-range transmission manager, wherein the long-range transmission manager is configured to permit only one member of the cluster at a time to transmit using any power setting that falls outside the low power range.

84. The wireless network of claim 83, wherein the long-range transmission manager is further configured to allocate to the one member permission to transmit using a transmission frequency that falls within a collection of transmission frequencies.

85. The wireless network of claim 84, wherein each node in the cluster of nodes is configured to receive a data signal on the transmission frequency while no node in the cluster is transmitting on the transmission frequency.

86. The wireless network of claim 85, wherein each node in the cluster comprises:

a correlator configured to determine whether the data signal contains a pattern associated with the cluster.

87. A radio communications device for a wireless network having a multiplicity of other radio communications devices, comprising:

a transmitter configured to send data to any other radio communications device in the multiplicity using a power setting that falls within a low power range; and

a media access controller configured to receive a plurality of requests from the multiplicity of other radio communications devices to transmit using a power setting that falls within a high-power range;

wherein the media access controller is configured to grant only one request in the plurality of requests at a time.

88. The radio communications device of claim 87, further comprising a receiver configured to receive any transmission having a power level that falls within the high-power range while no radio communications device in the multiplicity of other radio communications devices is transmitting using the power level.

89. The radio communications device of claim 88, further comprising:

a correlator configured to determine whether the any transmission contains a pattern associated with a particular radio communications device in the multiplicity of radio communications devices.

90. The radio communications device of claim 88, further comprising:

a plurality of correlators, each one of the plurality of correlators being configured to determine which of the multiplicity of radio communications devices sent the any transmission.

91. In a wireless communications network comprising a multiplicity of nodes and configured to transmit a data stream along a route from a source node in the network to a destination node in the network according to a routing protocol, a method of managing real-time data traffic, the method comprising the steps of:

receiving at an intermediate node in the route a data packet from the data stream and a request to transmit the data packet to a next node in the route;

determining whether the next node is operating in a receiving mode;

if the next node is operating in the receiving mode, transmitting the data packet to the next node; and

if the next node is not operating in the receiving mode, forwarding the data packet to any other node in the multiplicity of nodes that is both in the receiving mode and nearer to the destination node than the intermediate node.

92. The method of claim 91, wherein the step of forwarding comprises the step of determining whether the any other node is operating in the receiving mode.

93. The method of claim 91, further comprising the step of periodically repeating the step of determining whether the next node is operating in the receiving mode.

94. The method of claim 91, further comprising the step of incorporating the data packet into a waveform containing a pattern uniquely associated with the next node.

95. The method of claim 94, wherein the next node comprises a correlator configured to detect the pattern.

96. The method of claim 91, further comprising the step of incorporating the data packet into a waveform containing a pattern uniquely associated with the any other node.

97. The method of claim 96, wherein the any other node comprises a correlator configured to detect the pattern.